

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 26

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MOHAMMED ANJUM, ALAN L. STUBER
and IBRAHIM K. BURKI

Appeal No. 1998-2925
Application 08/532,861

ON BRIEF

Before JOHN D. SMITH, OWENS, and LIEBERMAN, *Administrative Patent Judges*.

OWENS, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal from the examiner's final rejection of claims 1-7, 11 and 13-18, which are all of the claims remaining in the application.

THE INVENTION

Appellants claim a method for fabricating integrated circuits using doping with indium. Claims 1 and 11 are

illustrative:

1. A method for fabricating an integrated circuit, comprising:

providing an opening to an active region of a semiconductor substrate upper surface;

constructing a conductive gate across a portion of said active region; and

implanting only indium ions through said opening into said active region, wherein said implanting forms p-type source and drain regions within said active region simultaneously with indium within said conductive gate.

11. A method for reducing diffusion of p-type dopant from a patterned semiconductor gate conductor to an underlying channel region, the method comprising:

providing a semiconductor n-type substrate and a first layer of dielectric material across an upper surface of the substrate;

providing a conductive material across the dielectric material;

selectively removing a portion of the conductive material and underlying dielectric material to present a source region, a drain region and a patterned conductive gate having an exposed upper surface and a lower surface adjacent the dielectric material, said source and drain regions are spaced apart within said substrate by a channel region underlying the patterned conductive gate;

implanting indium into the conductive gate via the exposed surface to a concentration peak density at a first depth relative to the upper surface of said conductive gate, wherein said implanting indium step further comprises

Appeal No. 1998-2925
Application 08/532,861

implanting indium into the source and drain regions to a concentration peak density at a third depth relative to the upper surface of said substrate; and

implanting p-type dopant into the conductive gate via the exposed surface to a concentration peak density at a second depth relative to the upper surface of said conductive gate wherein the second depth is shallower than said first depth.

THE REFERENCES

Mitsui et al. (Mitsui)	5,296,401	Mar. 22, 1994
Yoshizumi et al. (Yoshizumi)	5,328,864	Jul. 12, 1994

C-M. Lin et al. (Lin), "Sub-100-nm p⁺-n shallow junctions fabricated by group III dual ion implantation and rapid thermal annealing", 54 *Appl. Phys. Lett.* 1790-92 (1989).

THE REJECTIONS

Claims 1-7, 11 and 13-18 stand rejected under 35 U.S.C. § 103 over Yoshizumi or Mitsui, in view of Lin.

OPINION

We reverse the rejections of claims 1-7 and affirm the rejections of claims 11 and 13-18. We denominate the affirmances as involving new grounds of rejection under 37 CFR § 1.196(b).

Appellants state that the claims stand or fall in two groups: 1) claims 1-7, and 2) claims 11 and 13-18 (brief,

page 5). We therefore limit our discussion to one claim in each group, i.e., claims 1 and 11. See *In re Ochiai*, 71 F.3d 1565, 1566 n.2, 37 USPQ2d 1127, 1129 n.2 (Fed. Cir. 1995); 37 CFR § 1.192(c)(7)(1997).

The examiner relies upon Yoshizumi and Mitsui for disclosures of the elements of appellants' claims other than the use of indium as a dopant (answer, pages 4 and 6-7). Appellants do not challenge the rejection in this respect but, rather, argue that there is no suggestion in the references to combine their teachings, there is no suggestion to use only indium as the dopant as required by claim 1, and there is no suggestion to implant p-type dopant to a shallower depth than the depth of indium as recited in claim 11 (brief, pages 5-13).

The relevant disclosure in Lin regarding implanting indium as required by claim 1 is: "We have investigated both the single use of heavy group III (Ga and In) ions for creating shallow junctions and the dual implant approach where Ga or In was first used for preamorphization (and doping) followed by a B or BF₂ implant" (page 1790). Lin does not

disclose whether the In functioned effectively when it was investigated.

The examiner argues that it would have been obvious to one of ordinary skill in the art to substitute Lin's In or dual In/B or In/BF₂ for the boron of Yoshizumi or Mitsui because of the benefits disclosed by Lin such as low leakage current densities, good ideality factors, shallow junctions and low sheet resistances (answer, pages 5-8). These benefits, however, are disclosed as being obtained by use of dual implants, not single element implants (abstract).

The examiner argues that Lin teaches that a single implant is effective (answer, page 9). The single implant element, however, is Ga, not In (page 1791 and page 1792, table I). The examiner argues that data for Ga and In are comparable (answer, page 10). Even though appellants challenge this argument (reply brief, page 3), the examiner provides no supporting evidence. The examiner's mere speculation is not sufficient for establishing a *prima facie* case of obviousness. See *In re Warner*, 379 F.2d 1011, 1017, 154 USPQ 173, 178 (CCPA 1967), *cert. denied*, 389 U.S. 1057

(1968); *In re Sporck*, 301 F.2d 686, 690, 133 USPQ 360, 364 (CCPA 1962).

The examiner argues that appellants' claim 1 does not exclude a dual implant (answer, pages 9-10). A dual implant, however, is excluded by "implanting only indium ions".

For the above reasons, we conclude that the examiner has not carried the burden of establishing a *prima facie* case of obviousness of the method recited in claim 1. We therefore reverse the rejections of this claim and claims 2-7 which depend therefrom.

As for claim 11, the examiner argues that it would have been obvious to one of ordinary skill in the art to obtain an implantation depth of indium greater than that of a p-type dopant by optimization (answer, pages 6 and 8). The examiner, however, provides no explanation as to why optimization necessarily would produce these relative depths or why the applied references would have led one of ordinary skill in the art to optimize in such a way that these relative depths are obtained. Again, the examiner relies upon mere speculation, and such speculation is not sufficient for establishing a

prima facie case of obviousness.

Lin, however, discloses implantation of In at a depth which is greater than that at which boron (a p-type dopant) is implanted (page 1791, lower portions of figure 1 (a) and (d)). Appellants argue that the depths are approximately the same (reply brief, page 7), but the lower portions of figure 1 (a) and (d) show an In implantation depth greater than the boron implantation depth, which is all that appellants' claim 11 requires in this respect. Use of In/B dual implantation in the methods of Yoshizumi and Mitsui, including implantation using the disclosed In implantation depth greater than the B implantation depth, would have been fairly suggested to one of ordinary skill in the art by Lin, to obtain the above-discussed benefits disclosed by Lin of his dual implantation.

Appellants argue that Lin discloses only implants for shallow junctions such as source/drain regions, not gates, and that an implant that is suitable for a source/drain region is not necessarily suitable as a gate implant (reply brief, page 5). This argument is not well taken because, first, it is an unsupported argument by appellants' counsel, and such argument

cannot take the place of evidence. See *In re De Blauwe*, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984); *In re Payne*, 606 F.2d 303, 315, 203 USPQ 245, 256 (CCPA 1979); *In re Greenfield*, 571 F.2d 1185, 1189, 197 USPQ 227, 230 (CCPA 1978); *In re Pearson*, 494 F.2d 1399, 1405, 181 USPQ 641, 646 (CCPA 1974). Second, for a *prima facie* case of obviousness to be established, the expectation of success provided by the prior art needs only to be a reasonable one; absolute certainty is not required. See *In re O'Farrell*, 853 F.2d 894, 903-04, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988). Because, as acknowledged by appellants (specification, page 1, lines 11-15), it was conventional to implant both the gate oxide and adjacent source/drain regions with an impurity dopant, it reasonably appears that the disclosure by Lin regarding doping source and drain regions of metal-oxide-semiconductor field-effect transistors (page 1790) would have provided one of ordinary skill in the art with a reasonable expectation of success in using the disclosed dopants to dope both the source/drain and gate regions.

Accordingly, we affirm the examiner's rejections of

Appeal No. 1998-2925
Application 08/532,861

claims 11 and 13-18 over the applied references. Because our reasoning differs substantially from that of the examiner, we denominate these affirmances as involving new grounds of rejection under 37 CFR § 1.196(b).

DECISION

The rejections of claims 1-7 under 35 U.S.C. § 103 over Yoshizumi or Mitsui, in view of Lin, are reversed. The rejections of claims 11 and 13-18 under 35 U.S.C. § 103 over Yoshizumi or Mitsui, in view of Lin, are affirmed. These affirmances are denominated as involving new grounds of rejection. This decision contains new grounds of rejection pursuant to 37 CFR § 1.196(b) (amended effective Dec. 1, 1997, by final rule notice, 62 Fed. Reg. 53,131, 53,197 (Oct. 10, 1997), 1203 Off. Gaz. Pat. & Trademark Office 63,122 (Oct. 21, 1997)). 37 CFR § 1.196(b) provides that "[a] new ground of rejection shall not be considered final for purposes of judicial review."

37 CFR § 1.196(b) also provides that the appellants, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of the following two options with respect to the new

Appeal No. 1998-2925
Application 08/532,861

grounds of rejection to avoid termination of proceedings (37
CFR § 1.197(c))

as to the rejected claims:

(1) Submit an appropriate amendment of the claims
so rejected or a showing of facts relating to the
claims so rejected, or both, and have the matter
reconsidered by the examiner, in which event the
application will be remanded to the examiner....

(2) Request that the
application be reheard
under § 1.197(b) by the Board of Patent Appeals and
Interferences upon the same record...

No time period for taking any subsequent action in con-
nection with this appeal may be extended under 37 CFR §
1.136(a).

AFFIRMED-IN-PART, 37 CFR § 1.196(b)

)	
JOHN D. SMITH)	
Administrative Patent Judge)	
)	
)	
)	BOARD OF PATENT
TERRY J. OWENS))
Administrative Patent Judge)	APPEALS AND
)	

Appeal No. 1998-2925
Application 08/532,861

PAUL LIEBERMAN
Administrative Patent Judge

) INTERFERENCES
)
)
)

KEVIN L. DAFFER
CONLEY, ROSE & TAYON
P. O. BOX 3267
HOUSTON, TX 77253-3267

TJO:caw